dishes. The wind quickly dries the ground, and declines towards night to moderate airs. The influence of these causes is so powerful that I have seen the mercury in the thermometer placed upon the straw between the dishes descend to 27°, when three feet above the ice-pits it was 48°.

So powerful is the cooling effect of radiation on clear nights in tropical climates, that in very favourable mornings, during the cold season, drops of dew may sometimes be found congealed in Bengal upon the thatched roofs of houses, and upon the exposed leaves of plants. In the evening the cooling process advances more rapidly than could be supposed by one who has not experienced it himself, and proves the justness of his feelings, by the aid of the thermometer. In the open plain on which the ice is made, I have seen the temperature of the air, four feet above the ground, fall from 70·5° to 57°, in the time the sun took to descend the two last degrees before his setting.

The tropical rains are succeeded by the cold season, when the night is cold, the sky quite clear, and the air becomes a bad conductor of electricity, from the dry northern winds which then prevail. This is proved by the rapidity with which evaporation proceeds, by the dispersion of clouds, and by the more evident proofs which the hygrometer exhibits. During the cold season vegetation proceeds, and electricity continues to be evolved by living bodies, and during their decomposition.

These remarks will enable us to explain the process by which the ice is prepared in Bengal.

1st. The large quantity of dry straw and moist dishes rapidly become cold, by their powerfully radiating surfaces, at the same time that the large body of dry straw strongly attracts positive electricity, and the descending currents of air deposit moisture in the dishes of water. Hence, during a cold and clear night, with airs from the N.N.W., the cooling process will advance more rapidly in proportion to the non-electric or attractive nature of the body, which, with the radiating power of the surface, regulates the cold and the quantity of dew deposited upon the body.

2nd. The high and dry situation and free exposure of the ice-fields to the sky, and the absence of all causes which could interrupt the influence of the large body of non-electrics, and the extensive surface of powerful radiating substances, sufficiently accounts for the degree of cold produced in the ice plates; and

3rd. The cool, dry north-west airs slowly pass over the ice-beds, absorbing the accumulation of moisture and of heat, which is given off by the liquefying of a large quantity of water that would otherwise accumulate over the beds; and, thus retaining the air clear and dry, allows the full operation of the other causes, particularly radiation.

T. A. WISE

NOTES

THE Academy of Sciences in Paris publishes the following telegrams received from M. Janssen. One dated Ootacamund, 18th December, $1^{h}\,6^{m}$ P.M., says: "Great hydrogenous atmosphere very rare beyond chromosphere." The other, received on the 19th December by the Minister of Public Instruction, but not dated, simply says: "Eclipse observed; important results."—The Royal Academy of Sciences at Amsterdam has received the following telegram from one of its members, Dr. Oudemans, of Batavia:—"Preliminary results: Corona distinctly seen, pure white rays, dark rifts as far as the moon's limb; no outline of chromosphere; radial polarisation of Corona; no magnetic disturbances; moving shadows positively observed."

AT the meeting of the French Academy, held on Saturday last, to fill up the four vacant chairs, M. Thiers, M. de Remusat, Minister for Foreign Affairs, and M. Dufaure, Minister of Justice were present and voted. The first election was for a successor to Montalembert, and the Duc d'Aumale received 28 votes, one blank vote being recorded. For M. Villemaine's chair there were three candidates, M. Littré, who obtained 17 votes; M. Taillandier, 9; and M. de Viel Castel, 3. There were six candidates for M. Prévost-Paradol's chair. M. Camille Rousset had 17 votes; M. de Viel Castel, 7; M. de Mazade, 3; M. de Lomenie, 1; M. Taillandier, 1; and M. Mary-Lafon, 0. The choice of a successor to Prosper Mérimée was only made after two ballotings. At the first essay M. Edmond About obtained 13 votes; M. de Lomenie, 13; M. de Viel Castel, 2; M. de Mazade, 1; and M. Mary-Lafon, 0. At the second ballot M. de Lomenie received 15 votes, and M. Edmond About 14. Previous to the election a protest in the form of a lengthy pamphlet was distributed among the Academicians by the Bishop of Orleans, who, while professing the utmost respect for the personal character of M. Littré, declared that now, as in 1863, he opposed the admission into the Academy of one who in his writings was the defender of Materialism, Atheism, and Socialism. We learn that in consequence of M. Littré's election, Monseigneur Dupanloup has resigned his seat in the Academy.

WE greatly regret to hear of the death, announced by telegram, from choleraic diarrhœa, of the Venerable John Henry Pratt, M.A., Archdeacon of Calcutta. He was educated at Caius College, Cambridge, where he took his B.A. degree in 1833, when he was third wrangler, the Masters of Christ's and Sidney Sussex Colleges being also wranglers, with Dr. Boustead, afterwards Bishop of Lichfield. In 1838 he was appointed to a chaplaincy in connection with the East Indian Company, and in 1850 was nominated to the Archdeaconry of Calcutta, which he held up to the time of his death. He was well-known for his researches of the interior structure of the earth, and had been a frequent contributor to our columns.

DR. GUSTAV RADDE, Director of the Natural History Museum at Tiflis, has just returned to that town from an interesting journey to the head waters of the Euphrates. Mr. H. E. Dresser has received a letter from him, dated Tiflis, Dec. 14, from which we translate the following extract, viz.:—"Early in August I ascended, in company with Dr. Siewers, a young geologist, the Great Ararat, and we reached an altitude of 14,233 feet above the sea level. Our journey extended over three months, and we have brought back a splendid botanical collection, many good insects, and geological specimens. You will read full particulars ere long in Petermann's 'Mittheilungen.' As regards ornithology, I have not, I am sorry to say, time now to write further respecting the good materials we gathered together, and am just leaving home for another month."

THE Professors to the Newcastle-on-Tyne College of Physical Science have determined to institute evening classes, to commence immediately after the winter vacation, for the purpose of giving instruction in their respective subjects to persons who are unable to attend their day classes. The Professors wish it to be understood that the instruction given in these classes will be such as to require a certain amount of real study on the part of those who attend them.

THE Curator of the Clifton College Museum, Mr. Barrington Ward, has issued a circular asking for donations, to which we are glad to call attention. The following extract will show the very wise limitation placed on the acceptance of specimens:—"It has been decided, with the approval of the Head Master, that the museum shall be essentially a British one, and shall illustrate the natural history and antiquities of our land by good specimens, systematically arranged, under the departments of zoology, botany, geology, mineralogy, and archæology. In addition to this there will be a collection of rare and curious objects, derived from all sources, which may be considered useful for the purposes of scientific teaching, and a large typical series to be used at the lectures and demonstrations given in the College on Comparative Anatomy and other branches of Natural History. The committee of management will only accept of such specimens as can be classed under some one of these heads." In the Botanic Garden attached to the College nearly a thousand species of hardy herbaceous plants are now grown.

We have received the Preliminary Report by Mr. Sidney I. Smith, on the dredging in Lake Superior; and a reprint from the *American Journal of Science and Art* for December, of Mr. S. I. Smith and Mr. A. S. Verrill's notice of the Invertebrata dredged in the same expedition. The main facts of these reports are already before our readers.

A Society of Arts, Sciences, and Letters, has just been started at Winona, Minnesota, in connection with the first State Normal School in that place, having for its object the collection of facts and materials looking toward the determination of the natural history, archæology, and general literature of the United States.

Dr. Hoy, in a paper read before the Wisconsin Academy of Sciences, Arts, and Letters, remarks, in reference to the mammals of Wisconsin, that the elk existed in that State as late as 1863, but is now probably extinct. The moose is still found in considerable numbers. The last buffalo was killed in 1832. Antelopes were also found in Wisconsin in the time of Father Hennepin, although now, of course, driven far to the west. Most of the wild animals are diminishing very rapidly in number, the panther and deer being almost exterminated. The otter and beaver, however, are very persistent. The last wild turkey was killed in 1846 near Racine.

A scientific commission in the interest of the Government of Peru has lately been investigating the guano deposits of the Lobos Islands; and it is reported that the result of their inquiries has been very satisfactory, and that immense quantities of very rich guano, equal, if not superior, to that of the Chincha Islands, have been observed. The analyses of samples are said to have yielded over 13 per cent. of ammonia. Should this be the fact, Payta, as being the nearest port, will probably become a place of considerable importance.

The Report presented to, and read before, the Board of Visitors appointed by Government for the Royal Observatory, Edinburgh, after summarising the work done at the Observatory during the year, calls attention to the very inefficient manner in which the establishment is provided with funds for its necessary work, and to the scanty salary of its director and assistants. The Board of Visitors estimates the increased annual expenditure necessary to ensure the efficient working of the establishment at 1,050*l.*, including 300*l.* increase in the salary of the Astronomer Royal. The report is accompanied by a coloured plan of the Observatory, showing the position of the various instruments, and diagrams of the quarterly means of the earth thermometers from 1837 to 1869; annual mean temperatures, for four several sub-annual epochs, of the rock at the Observatory in the same years; annual means of Schwabe's sun-spots, the earth thermometers, and others at Edinburgh; and eleven-year means for every successive year, from 1842 to 1864, of Schwabe's sun-spots and Edinburgh earth temperatures.

The seventh Report of the Board of Visitors of the Observatory at Victoria, with the Annual Report of the Government Astronomer, is printed. The report of the buildings and instruments is in every respect satisfactory.

Mr. W. H. Archer has brought down his records of patents and patentees for the colony of Victoria to the end of 1869; and the Reports of the Mining Surveyors and Registrars for the same colony are printed for the quarter ending June 30, 1871.

The Report of the New Zealand Institute for its fourth session, 1871, contains the Annual Address, delivered by Sir G. F. Bowen, and a list of donations and deposits in the Museum, and the Laboratory Report for 1870–71. Captain Hutton has prepared a complete catalogue, with a diagnosis, of each species of bird in New Zealand; and arrangements have been made for the publication of similar catalogues of the insects, fishes, and other branches of zoology in the island.

We have received the last two Annual Reports of the Plymouth Institution and Devon and Cornwall Natural History Society, forming together vol. iv. of its Transactions. Though many of the papers and lectures reported refer to subjects which do not come within our scope, the volumes bear evidence of the zeal and success with which the natural and physical sciences are pursued in the Western counties. Among the papers specially deserving of mention, we may notice, "Degeneration of our Deep-sea Fisheries," by Mr. J. N. Hearder; "The Fulgarator," a new electrical apparatus for producing electric sparks of very great length, by the same; "Rain," by W. Pengelly, F.R.S.; "Mistletoe on the Oak," by T. R. Archer Briggs; "The principles on which ships' sail-carrying power and steadiness in a sea-way depend," by W. Froude, F.R.S.

A Prospectus is issued of a third enlarged and improved edition of Von Cotta's "Geology of the Present." Special reference will be made in this edition to the bearing on geological questions of the recent discoveries of Darwin, Mayer, and Helmholtz.

The first number lies on our table of "The Mining Magazine and Review; a Monthly Record of Mining, Smelting, Quarrying, and Engineering," edited by Mr. Nelson Boyd. The principal articles in this number are—"The Coal Commission," by the editor; "Boiler Explosions," by E. B. Marten; "The Importance of Nitro-glycerine Explosives for Underground Quarrying Purposes," by S. J. Mackie; and "The Progress of Mineralogy," by F. W. Rudler. It contains also reviews, records of scientific progress, and miscellanea.

A little pamphlet by Mr. J. G. Fitch, entitled "Methods of Teaching Arithmetic," a lecture addressed to the London Association of Schoolmistresses, and published at the request of the Association, deserves a far wider circulation than among schoolmistresses only. We venture to say that if the admirable plan suggested in the lecture were generally adopted by teachers, of explaining in a rational manner the principles of the simple rules of arithmetic, which are generally learned by rote without the least exercise of intelligence on the part of either teacher or pupil, the teaching of arithmetic would soon cease to be the drudgery which it now is in both boys' and girls' schools, and the results, as exemplified by the reports of the Cambridge examiners and elsewhere, would be very different.

The "Proceedings of the South Wales Institute of Engineers," Vol. vii., No. 4, contains an important paper by Mr. Thomas Joseph, "On Colliery Explosions in the South Wales Coal Field," which is also reprinted in a separate form. We find in it also many other papers and discussions of value to the engineering and coal interests.

Mr. E. Parfitt reprints from the "Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art" two interesting papers—"The Fauna of Devon, Part vii.: Cirripedia," and "On the Boring of Molluscs, Annelids, and Sponges into Rock, Wood, and Shells."

We have received from Messrs. Nelson and Sons some specimens of Pictorial Natural History, consisting of packets of cards with coloured pictures of birds and some short account of each appended; they are as a series unusually good and elegant, though of unequal merit. Any of them would make a charming present for an intelligent child.

ON November 10 there was an earthquake in Salvador in Central America, and on the 12th a stronger one. At Simla there was an earthquake on November 25. Two sharp shocks were felt at Macedonia on November 26 at 11 P.M.

WHAT is called the Iquique earthquake took place on Oct. 8, at 1 A.M. Although alarming and lasting two minutes, with a terrible shaking of the earth, first vertical and afterwards oscillatory, it did no damage at Iquique. It was, however, simultaneously felt elsewhere, and has destroyed or damaged the towns of Tarapaca, Usmagama, Guasquina, Pica, Matilla, and the village of Pachica. Some persons were injured, but only two lost their lives.

AT a recent meeting of the Scientific Committee of the Horticultural Society, a letter was read from Mr. Anderson-Henry (printed in the *Gardeners' Chronicle* for Dec. 9), in which he gave some curious results of his observations on climbing plants. Mr. Henry stated that certain climbers evince a partiality for some other species, stretching out their tendrils or branches so as to come in contact with them, while to other species they have as strong an aversion, avoiding them and never touching them, though they may run up the same wall side by side. The subject is a curious one, and deserves further investigation.

"THE Fortunate Isles," translated from the French of Ogier, is an account of the Canaries. A chapter on the celebrated dragon tree contains the two passages here transcribed. Written apparently in sober earnest, they are, perhaps, not the least remarkable contribution to the scientific literature of the year now ended. "It is an undoubted fact that before the great Mediterranean deluge, and to a certain point even after it, strange creatures brought forth in transitional periods, inhabited the marshy grounds or those shallow seas which still remained warm. This epoch, called by modern geologists the Reptile Period, produced creatures belonging at once to the animal, vegetable, and mineral kingdoms, or to two only; monstrous products of creative forces; birds, quadrupeds, fish, plants, reptiles, all at once, either united or distinct; the greater number of these have been restored for us by geologists. . . . . The dragon has existed. The first men saw the last survivors of these prodigious creatures, and the memory of them has been preserved. The struggles of mankind with the mighty creatures which overran the earth must have been terrible. The excessive alarm of men possessing no weapons in the first ages, gave rise to the traditions of formidable beings attacking mankind and destroyed by the demi-gods, strong and brave men."

FROM the *Elizabeth Daily Journal* of New Jersey of Nov. 28 we have a marvellous story of a carrier pigeon, which we commend to the notice of Mr. Tegetmeier. It performed the journey from Sopus Farm, Warren Co., N.J., to Sandusky Ohio, a distance of 400 miles, in exactly an hour, and its condition on its arrival at the latter place is thus described:—"I found the greatest excitement had followed the arrival of the pigeon. Mr. Smythe told me that at precisely two o'clock the bird came like an arrow into his house. His movement was more like a blue streak than a well-defined bird. He seemed but little exhausted, although nearly all the feathers were off his body, except the small patch held on his back by the gutta-percha which fastened the note. A few miles more would have worn every feather from his wings, and then he would have to depend upon the momentum already acquired to carry him on his journey, and to steer by a tailless rump, and perhaps be killed in attempting to alight." No wonder the owner offers to match this pigeon "when he has grown a new suit of feathers" for 1,000 dollars against any carrier pigeon that has not done this distance in an equal time.

PERIODICITY OF SUN-SPOTS*

IN the short account of some recent investigations by Prof. Wolf and M. Fritz on Sun-spot phenomena, which has been published lately in the "Proceedings of the Royal Society" (No. 127, 1871), it was pointed out that some of Wolf's conclusions were not quite borne out by the results which we have given in our last paper on Solar Physics in the Philosophical Transactions for 1870, pp. 389-496. A closer inquiry into the cause of this discrepancy has led us to what appears a definite law, connecting numerically the two branches of the periodic sun-spot curve, viz., the time during which there is a regular diminution of spot-production, and the time during which there is a constant increase.

It will be well, for the sake of clearness, to allude here again, as briefly as possible, to Prof. Wolf's results before stating those at which we have arrived.

Prof. Wolf has previously devoted the greater part of his laborious researches to a precise determination of the mean *length* of the whole sun-spot period, but latterly he has justly recognised the importance of obtaining some knowledge of the average character of the periodic increase and decrease. Hence he has, as far as he has been able to do so by existing series of observations, and his peculiar and ingenious method of rendering observations made at different times and by different observers comparable with each other, endeavoured to investigate more closely the nature of the periodic sun-spot curve, by tabulating and graphically representing the monthly means taken during two and a half years before and after the minimum, and applying this method to five distinct minimum epochs, which he has fixed by the following years:—

1823·2
1833·8
1844·0
1856·2
1867·2

In a table he gives their mean numbers, expressing the solar activity, arranged in various columns; and arrives at the following results:—

(1) It is shown now with greater precision than was previously possible, that the curve of sun-spots ascends with greater rapidity than it descends. The fact is shown in the subjoined diagram, which it may be of interest to compare with the curves given previously by ourselves in the above-mentioned place. The zero-point in this diagram corresponds to the minimum of each period; the abscissæ give the time before and after it, viz., two and a half years, or thirty months; the ordinates express the amount of spot-production in numbers of an arbitrary scale. The two finely dotted curves are intended to show the actual character of a portion of two periods only, viz., those which had their minima in 1823·2 and 1867·2; the strongly dotted curve, however, gives the mean of all periods (five) over which the investigation extends.

(2) Denoting by x the number of years during which the curve ascends, and presuming that the behaviour is approximately the same throughout the whole period of 11·1 years as during the five years investigated, we have the proportion

$$x : 11\cdot1 - x :: 1 : 2,$$

whence $x = 3\cdot7$,

or the average duration of an ascent is 3·7 years, that of a descent 7·4 years.

(3) The character of a single period may essentially differ from the mean, but on the whole it appears that a $\left\{\begin{matrix}\text{retarded}\\ \text{accelerated}\end{matrix}\right\}$ descent corresponds to a $\left\{\begin{matrix}\text{retarded}\\ \text{accelerated}\end{matrix}\right\}$ ascent. Thus the minimum of 1844·0 behaved very normally; but that of 1856·2, and still more that of 1823·2, shown in the following diagram, presents a retarded ascent and descent; on the other hand, the minimum of 1833·8, and still more in that of 1867·2, also shown in the diagram, both ascent and descent are accelerated.

Finally Prof. Wolf arranged in the manner shown in the following table the successive minima and maxima, in order to arrive at some generalisation which might enable him to foretell the general character and length of a future period. Taking the absolute differences in time of every two successive maxima, and

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* Abstract of paper read before the Royal Society December 21, 1871. "On some recent Researches in Solar Physics, and a Law regulating the time of duration of the Sun-spot Period." By Warren De La Rue, F.R.S., Balfour Stewart, F.R.S., and Benjamin Loewy, F.R.A.S.